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ABSTRACT

The present investigation looked at selective attention in impulsive and reflective children using a central/incidental task similar to that used by Hagen, 1967. In order to examine developmental change in selective attention, children at kindergarten, second, and fifth grades were tested. The central recall task involved presenting the child with a board containing pictures on 3" x 5" cards. The child was then presented with each of the cards and asked to point to the spot on the original board where the picture had been seen. It was hypothesized that impulsive children would demonstrate less efficient selective attention and, as a result, would recall less central information and possibly more incidental information than their reflective counterparts. The results showed that the impulsive children recalled less central as well as incidental information, which did not support the notion that impulsive children were deficient in selective attention. Results did support the developmental trend in the recall of central information found in previous investigations described by Hagen (Hagen & Hale, 1973). Impulsive and reflective children appear to differ on dimensions other than response latency. (Author/PC)

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SCOPE OF INTEREST NOTICE

SELECTIVE ATTENTION OF IMPULSIVE AND REFLECTIVE CHILDREN

U.S. DEPARTMENT OF HEALTH EDUCATION & WELFARE NATIONAL INSTITUTE OF EDUCATION

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Byron Egeland and Anne Thibodeau
University of Minnesota

Research, Development and Demonstration
Center in Education of Handicapped Children
Minneapolis, Minnesota

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The research reported herein was performed pursuant to a grant from the Bureau of Education for the Handicapped, U. S. Office of Education, Department of Health, Education, and Welfare to the Center of Research and Development in Education of Handicapped Children, Department of Special Education, University of Minnesota. Contractors undertaking such projects under government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent offical position of the Bureau of Education for the Handicapped.

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RESEARCH AND DEVELOPMENT CENTER
IN EDUCATION OF HANDICAPPED CHILDREN
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The University of Minnesota Research, Development and Demonstration Center in Education of Handicapped Children has been established to concentrate on intervention strategies and materials which develop and improve language and communication skills in young handicapped children.

The long term objective of the Center is to improve the language and communication abilities of handicapped children by means of identification of linguistically and potentially linguistically handicapped children, development and evaluation of intervention strategies with young handicapped children and dissemination of findings and products of benefit to young handicapped children.

Selective Attention of Impulsive and Reflective Children

Byron Egeland Anne Thibodeau

Recently there has been an increasing awareness of conceptual tempo as an important dimension to consider in attempting to understand the way young children learn. Conceptual tempo refers to the way in which a child responds to tasks of high response uncertainty. A child who responds quickly and with less accuracy in situations of high response uncertainty is typically labeled cognitively impulsive (Kagan, 1965). The operational index of the reflection-impulsivity dimension is response latency and number of errors on Kagan's Matching Familiar Figures Test (MFF). The MFF is a visual discrimination match-to-sample task that involves finding one of six alternatives that exactly matches a standard.

The educational interest in conceptual tempo stems from the fact that it has been shown that the performance of reflective children is generally superior to that of impulsive children on tasks such as intelligence tests (Harrison & Nadelman, 1972), reading (Kagan, 1965), arithmetic achievement (Cathcart & Liedtke, 1969), and school success in general (Messer, 1970). In addition, the modification of impulsive responding has been shown to have a positive effect on the child's reading performance (Egeland, 1974). The difficulty that impulsive children have with tasks such as reading may be due to the fact that they process information in an inefficient way.

Based on eye movement studies of impulsive children there is evidence to indicate that they have difficulty breaking a stimulus down into component parts and focusing on the distinctive features of those component parts (Seigelman, 1969; Drake, 1970). These investigators found that impulsive

children ignore many alternatives when solving a match-to-sample task and use only a fraction of the information available. Impulsive children appear to locate an alternative, spend a disproportionate amount of time looking at it, and then select that alternative as the correct one without considering the other alternatives. Rather than break the stimulus down into component parts, impulsive subjects compare the alternative globally with the standard and attempt to eliminate or confirm it on a global basis.

These studies suggest that impulsive children are deficient in their ability to attend selectively to critical features of a stimulus display and ignore other irrelevant features. This capacity corresponds to the filtering mechanism proposed by the information processing models of Broadbent (1958), Neisser (1967), and Treisman (1969). The models suggest that a filtering mechanism causes certain information in the individual's environment to be attended to and other information ignored. Impulsive children quite likely fail to inhibit attention to incidental information in a stimulus display.

Hagen has utilized a central/incidental recall paradigm derived from the filter models of information processing to investigate selective attention. The basic experimental situation involves a brief presentation of a stimulus display, certain elements of which are designated as central information. Immediately following presentation, recall of central and incidental information is assessed. High incidental learning is assumed to indicate attention to the incidental aspects of the display, while high central learning in combination with low incidental learning is assumed to indicate selective attention to the task relevant information. Hagen (1967) reports a developmental increase in the ability to attend selectively. Central task performance improved with age, while incidental performance

did not increase and actually decreased slightly at the oldest age level. Correlational analyses from the same study indicate a positive correlation between central and incidental task scores at the younger age levels, but negative correlations at the oldest age levels.

According to Hagen and Hale (1973), results seem to indicate that incidental learning is determined by a process which involves two stages. The first stage is an initial discrimination of the relevant and irrelevant material and the second stage involves focusing attention on certain information for further processing, storage in memory and later retrieval. While there may be developmental improvement in both stages, Hagen contends that the developmental improvement in selective attention reflects age differences in performance at the second stage. The findings of Drucker and Hagen (1969) support this view in that the developmental trend toward increased selective attention was not significantly changed by attempts to increase the degree to which discrimination of the relevant and irrelevant materials was possible. According to Hagen and Hale (1973), the negative correlation between central and incidental information in older subjects indicates that success in task performance is accomplished, at least in part, due to inhibition of attention to incidental information.

The present investigation looked at selective attention in impulsive and reflective children using a central/incidental task similar to that used by Hagen. In order to examine developmental change in selective attention, children at kindergarten, second, and fifth-grade levels were tested. It was hypothesized that impulsive children would demonstrate less efficient selective attention, recalling less central information than their reflective counterparts and possibly more incidental information. It was expected

that reflective children would recall more central information than incidental information, with the magnitude of this difference increasing developmentally. In addition, based on Hagen's developmental findings, it was hypothesized that the combined data of impulsive and reflective children would show an increase in central recall and a decrease in incidental recall for older children.

Method

Subjects

Initially, 90 kindergarten, 106 second-grade and 125 fifth-grade children from a suburban Minneapolis school system were administered the Matching Familiar Figures test. Based on response time and total errors on the test, a double median split was used to select a sample of 36 impulsive and 36 reflective children at each grade level. The sample consisted of 33 boys and 39 girls ranging in age from 5 years, 5 months to 6 years, 7 months at the kindergarten level; 37 boys and 35 girls ranging in age from 7 years, 5 months, to 9 years, 3 months at the second-grade level; and 28 boys and 44 girls ranging in age from 10 years, to 12 years, 7 months at the fifth-grade level.

Materials

Materials used in this study were adapted from Hagen (1967). Stimuli for the central/incidental task were presented on a 22" x 10" board on which five 3" x 5" cards were secured and outlined in black. On each of the five cards were two black line drawings. The drawings were pairings of animals and household objects: cat-lamp, dog-table, fish-telephone, camel-TV, deer-clock. The animal drawing always appeared in the upper position and the drawings were approximately one-half inch apart. Ten additional 3" x 5"

cards were used, each containing a drawing of an animal or household object identical to those which appeared on the set of cards containing the animal and object pairs. The drawings on the cards containing either the animal or object always appeared in the same position on the cards as they had on the cards with animal and object pairs. For the incidental recall task, five 2 1/2" x 3" cards were used, each containing a drawing of an animal identical to that which appeared on the cards containing pairs. A 22" x 10" white card was used in testing recall of central information. Five 3" x 5" rectangles outlined in black appeared on one side of the card.

Procedure

The procedure for this study involved individual testing of subjects. The stimuli board containing five cards with drawings was placed before the subject. The pictures of animals were designated as central information in this study and after the pairs of drawings were exposed to the child for eight seconds a second board was used to cover the stimuli. Before the stimuli were exposed, the child was told that his task was to try to remember the position of each animal picture on the stimuli board. The instructions were repeated until the experimenter felt that the child understood what he was to do. Immediately following exposure to the stimuli, Ss were administered tasks to assess recall of central and incidental information.

The central recall task involved presenting the child the board containing the outlines of 3" x 5" cards. The child was then presented each of the 3" x 5" cards having a drawing of an animal and asked to point to the box where that animal had been seen. For the incidental recall task, the subject was shown an array of the five cards having only drawings of household objects. The child was handed the 2 1/2" x 3" cards containing animal drawings, one at a time, and instructed to indicate which household object the animal had

been paired with. Total testing time for this task was approximately 10 minutes.

At each grade level, one-half of the impulsive and one-half of the reflective subjects performed the central recall task first while the other half of the subjects in each group performed the incidental recall task first. Performance on the central and incidental tasks was designated in terms of errors on each task. Errors on the central task consisted of failure to indicate the correct position of the animal on the board. Errors on the incidental recall task consisted of failure to match the household object with the animal drawing originally paired with that object.

Following completion of the central/incidental task, each subject was administered Form B of the Peabody Picture Vocabulary Test. This IQ measure was used to determine if possible IQ differences existed between the impulsive and reflective group.

Results

Initially, sex differences on the selective attention task and on the MFF were analyzed as well as IQ differences between impulsive and reflective groups. Impulsive children had a mean IQ of 107.6, which is not significantly different from the mean of 109.1 for the reflective group ($F = 1.09$, $df = 1/24$). The MFF mean time and error scores for impulsive and reflective subjects at each grade level are reported in Table 1. The mean number of errors on the MFF was 13.7 for boys and 12.1 for girls which is not a significant difference ($F = 2.40$, $df = 1/214$). The mean length of time to first response was 133.4 seconds for boys and 148.3 for girls which again is not significant ($F = 1.11$, $df = 1/124$). Similarily, there were no sex differences in the mean number of errors made on the recall of central and incidental information. Mean number of errors on central recall for boys was 2.4 and for girls the mean

was 2.5 (F = .05, df = 1/214); on incidental recall the means were 4.0 and 3.8 for boys and girls respectively (F = .66, df = 1/214).

Insert Table 1 about here

A 2 (conceptual style) x 2 (order) x 3 (grade) analysis of variance was performed on the error scores for recall of central information as reported in Table 2. Main effects for conceptual style (F = 5.39, df = 1/204, $p < .02$), grade (F = 23.20, df = 2/204, $p < .0001$) and order (F = 12.12, df = 1/204, $p < .0006$) were found; however, there were no significant interactions.

Insert Table 2 about here

A similar analysis, which is reported in Table 3, was carried out on the error scores for incidental information. This analysis yielded a significant main effect for conceptual style (F = 5.53, df = 1/204, $p < .01$). There were no other significant main effects or interactions.

Insert Table 3 about here

Mean error scores for the impulsive and reflective groups for each grade are presented in Table 4. The mean number of errors on the central recall task for the reflective group across all grades was 2.2, while the mean errors for the impulsive group was 2.7, indicating significantly fewer central errors for the reflective group. Similar differences were found for error scores on incidental recall. The impulsive group had an average of 4.0 errors while the reflective group across all grade levels had a mean error score of 3.7 on incidental recall.

Combining central recall scores across impulsive and reflective groups shows that the kindergarten children had a mean error score of 3.2; second

grade, 2.4; and fifth grade, 1.6. The results indicate a developmental trend in the recall of central information with older children recalling more information than younger children. For recall of incidental information, the mean number of errors was approximately the same across the three grade levels.

Insert Table 4 about here

The significant main effect for order of presentation found in the analysis of central recall data indicated that more central information was recalled when central information was recalled first followed by recall of incidental information. When central information was recalled first, the mean number of errors was 2.1 and when central was recalled second the mean was 2.8. The mean number of errors when the incidental task was presented first and second was 3.9 and 3.8 respectively, which indicates that children made approximately the same number of errors on incidental recall regardless of whether the task was presented first or second.

Correlations between central and incidental error scores at each grade were -.09 for kindergarten; .04 for second grade; and .12 for fifth grade. These nonsignificant correlations contradict Hagen's (1967) previous findings of a positive correlation between central and incidental recall at the younger age levels and a negative correlation at the older age levels.

Discussion

It was hypothesized that impulsive children would demonstrate less efficient selective attention and as a result they would recall less central information and possibly more incidental information than their reflective counterparts. The results showed that the impulsive children recalled less central and incidental information as compared to reflective children, which does not support the notion that impulsive children are deficient in

selective attention as measured by Hagen's task. The poorer performance of the impulsive subjects on both central and incidental recall tasks suggests a deficiency in the ability to encode information for storage rather than a deficiency in selective attention. The relative difference in recall of central and incidental information was approximately the same for impulsive and reflective subjects with both groups recalling more central than incidental information. The central/incidental task involves two different recall tasks. While the central task involves recall of serial position, the incidental task is one of recalling paired associates. Since the degree to which these tasks can be compared has not been established, it is impossible to base conclusions about selective attention on the relative difference between central and incidental recall.

The overall poor performance of impulsive children cannot be explained in terms of the theories of selective attention presented by Hagen (Hagen & Hale, 1973) and Neisser (1967). The fact that reflective children recalled more central and incidental information suggests that these subjects utilized better strategies for information processing and recall. It is quite possible that the impulsive children dealt with the information in a global, undifferentiated way that resulted in less efficient processing of the information for later recall. Indirect evidence for the fact that impulsive children attend to stimuli in a global, undifferentiated fashion has been found in the eye movement investigations of Drake (1970) and Siegleman (1969) which show that impulsive children do not systematically analyze stimulus material or break it down into component parts. Impulsive subjects in this study may have processed the information in a global way and recalled the stimuli by use of iconic storage. This type of strategy is less efficient than a more

careful analysis of the material and use of verbal labeling, rehearsal and other memory strategies. Hagen and Kingsley (1968) and Wheeler and Dusek (1973) found that by forcing young children to label the stimuli they produced higher central recall scores. It would be interesting to determine if similar results would be obtained with impulsive children since they appear to process information in a way similar to younger children.

Unlike findings reported by Hagen (1967), the present results did not show positive correlations between central and incidental scores for younger children and negative correlations at older age levels. The correlations in the study were nonsignificant at each grade level. Although Hagen interprets these correlation differences to indicate that older subjects are actively excluding irrelevant information, the present findings do not support the conclusion that this is occurring.

The current results did support the developmental trend in the recall of central information found in previous investigations described by Hagen (Hagen & Hale, 1973). When data for impulsive and reflective children were combined, a significant developmental increase in recall of central information was found, but there was no significant difference in recall of incidental information over all age levels.

The results of the present investigation raise some questions regarding Hagen's selective attention task. The central/incidental task is basically a recall task and the child's ability to attend selectively is inferred from his recall score using two different recall tasks administered after a brief exposure to the stimuli. The order of recall of central and incidental information is a potentially important variable. In previous investigations (Hagen, 1967; Drucker and Hagen, 1969; Hagen and Huntsman, 1971), central

information was recalled before incidental information without counterbalancing groups to control for a possible order effect. In the present investigation, results indicate a significant order effect in recall of central information with significantly more errors being made when the central recall task was presented after the incidental task. There was no significant order effect for recall of incidental information. This order effect, which was also found in an earlier investigation by Wheeler and Dusek (1973), may account for the higher central recall scores found in previous investigations. Hale and Piper (1973) have pointed out that other factors, such as the spatial relationship of the stimuli or the use of multidimensional materials, must be taken into consideration in comparing evidence from various selective attention investigations.

The results of this investigation offer evidence to support the notion that impulsive and reflective children differ on dimensions other than response latency. The results of the present study suggest that impulsive children may benefit from training in information processing and recall skills. It seems likely that the poor academic achievement reported for impulsive children is associated with deficiencies in these skills. It has been demonstrated previously that impulsive children can be trained to better scan and analyze stimulus materials in terms of relevant component parts and this training results in some improvement in academic achievement (Egeland, 1974). Hunt (1973) has been successful in teaching retarded children to use various strategies for organizing and remembering materials. Similar training approaches involving labeling and rehearsal skills need to be attempted with impulsive children.

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Table 1

Mean Time and Error Scores on the
Matching Familiar Figures Test

Matching Familiar Figures Test	Grade		
	Kindergarten	Second	Fifth
	Reflective		
Errors	12.8	5.9	4.7
Time (Seconds)	166.5	256.0	202.3
	Impulsive		
Errors	25.0	16.6	11.9
Time (Seconds)	59.5	77.1	85.6

Table 2

Analysis of Variance Summary for Central Recall

Source	df	MS	F	p
Between A (Impulsive/Reflective)	1	10.66	5.39	.02
B (Grade)	2	45.92	23.20	.00001
C (Order)	1	24.00	12.12	.0006
A x B	2	1.51	.76	.ns
A x C	1	.46	.23	.ns
B x C	2	.51	.26	.ns
A x B x C	2	.199	.10	.ns
Error	204	1.98		

Table 3

Analysis of Variance Summary for Incidental Recall

Source	df	MS	F	p
Between A (Impulsive/Reflective)	1	6.34	5.53	.01
B (Grade)	2	2.20	1.91	.14
C (Order)	1	.11	.10	.ns
A x B	2	.06	.05	.ns
A x C	1	.23	.19	.ns
B x C	2	2.53	2.20	.11
A x B x C	2	.45	.39	.67
Error	204	1.15		

Table 4

Mean Error Scores for Central and Incidental Recall

Selective Attention	Grade		
	Kindergarten	Second	Fifth
	Reflective		
Central	2.9	2.1	1.6
Incidental	3.8	3.8	3.5
	Impulsive		
Central	3.5	2.8	1.7
Incidental	4.2	4.0	3.9

Footnote

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